the seventh left pixel in Fig. 19 corresponding to the third shutter time/v since the time of shutter opening and to the foreground component of the eighth left pixel in Fig. 19 corresponding to the fourth shutter time/v since the time of shutter opening.

Since the object corresponding to the foreground is a rigid body and may be assumed to be moving at an equal speed, with the movement quantity v being 4, the first foreground component F02/v of the sixth left pixel in Fig. 19, with the first shutter time/v since the time of shutter opening, is equal to the second foreground component of the seventh left pixel in Fig. 19 corresponding to the second shutter time/v since the time of shutter opening. Similarly, the foreground component F02/v is equal to the foreground component of the eighth left pixel in Fig. 19 corresponding to the third shutter time/v since the time of shutter opening.

Since the object corresponding to the foreground is a rigid body and may be assumed to be moving at an equal speed, with the movement quantity v being 4, the first foreground component F03/v of the seventh left pixel in Fig. 19, with the first shutter time/v since the time of shutter opening, is equal to the second foreground component of the eighth left pixel in Fig. 19 corresponding to the second shutter time/v since the time of shutter opening.

Although the number of times of the virtual splitting is four in the description with respect to Figs. 17 to 19, the number of times of the virtual splitting corresponds to the movement quantity v. The movement quantity v generally corresponds to the movement speed of the object corresponding to the foreground. For example, if the

object corresponding to the foreground is moving so as to be displayed four pixels rightwards in a frame next to a previous reference frame, the movement quantity v is 4. The number of times of the virtual splitting is set to 4 in association with the movement quantity v. Similarly, if the object corresponding to the foreground is moving so as to be displayed six pixels rightwards in a frame next to a previous reference frame, the movement quantity v is 6, with the number of times of the virtual splitting being six.

Figs.20 and 21 show the relation between the foreground area, background area, and the mixed area, comprised of the covered background area and the uncovered background area, on one hand, and the foreground and background components corresponding to the split shutter time, on the other hand, as described above.

Fig.20 shows an example of extraction of pixels of the foreground area, background area and the mixed area as extracted from a picture corresponding to an object moving before a still background. In the embodiment shown in Fig.20, an object corresponding to the foreground is moving horizontally with respect to the picture.

The frame #n+1 is a frame next to the frame #n, with the frame #n+2 being a frame next to the frame #n+1.

Fig.21 diagrammatically shows a model obtained on extracting pixels of the foreground area, background area and the mixed area, extracted in turn from one of the frames #n to #n+2, with the movement quantity v being 4, and on expanding the

pixel values of the extracted pixels along the time axis direction.

Since the object corresponding to the foreground is moved, the pixel values of the foreground area are constituted by four different foreground components corresponding to the period of the shutter time/v. For example, the leftmost one of pixels of the foreground area shown in Fig.21 are F01/v, F02/v, F03/v and F04/v. That is the pixels of the foreground area contain are corrupted with motion blurring.

Since the object corresponding to the background is at a standstill, the light corresponding to the background input to the sensor 11 during the time corresponding to the shutter time is not changed. In this case, the pixel values of the background are free of the motion blurring.

The pixel values or the pixels belonging to the mixed area composed of the covered background area or the uncovered background area are comprised of the foreground and background components.

A model comprised of neighboring pixels in a row in plural frames, in which the pixel values of pixels lying at the same position on a frame are developed in the time axis direction, with the picture corresponding to an object being moved, is explained. For example, if the picture corresponding to the object is moving horizontally with respect to the picture, the pixels arrayed on the same row on the picture may be selected as the pixels in a row in a picture.

Fig.22 diagrammatically shows a model obtained on temporally expanding the pixel values of pixels arrayed in a row of each of three frames of a picture of a

photographed object corresponding to a still background, with the developed pixels being at the same positicns on the respective frames. The frame #n is the frame next to the frame #n-1, with the frame #n+1 being the frame next to the frame #n. The remaining frames are termed in similar manner.

The pixel values of B01 to B12 shown in Fig.22 are those of pixels corresponding to the object of the still background. Since the objet corresponding to the background is at a standstill, the pixel values of the corresponding pixels in the frames #n-1 ti frame n+1 are not changed. For example, the pixel in the frame #n and the pixel in the frame #n+1, corresponding to the positions of the pixels having pixel values of B05 in the frame #n-1, are of pixel values of B05.

Fig.23 shows pixel values of neighboring pixels in a row in each of three frames of a photographed picture of an object corresponding to the foreground moving rightwards in Fig.23, along with the object corresponding to the still background, with the pixel values being shown developed along the time axis direction. The model shown in Fig.23 includes a covered background area.

In Fig.23, the object corresponding to the foreground is a rigid body and may be assumed to be moving at a constant speed, with the foreground picture being moved so that the foreground picture will be displayed four pixels rightwards in the next frame. So, the movement quantity v of the foreground is 4, with the number of times of the virtual splitting being 4.

For example, the foreground component of the leftmost pixel of the frame #n-1

in Fig.23, with the first shutter time /v since the opening of the shutter, is F12/v, whilst the foreground component of the second left pixel, with the second shutter time /v since the opening of the shutter, is also F12v. The foreground component of the third left pixel in Fig.23, with the third shutter time/v since the opening of the shutter, and the foreground component of the fourth left pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, are each F12/v.

For example, the foreground component of the leftmost pixel of the frame #n-1 in Fig.23, with the second shutter time /v since the opening of the shutter, is F11/v, whilst the foreground component of the second left pixel, with the third shutter time /v since the opening of the shutter, is also F11v. The foreground component of the third left pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, is F11/v.

The foreground component of the leftmost pixel of the frame #n-1 in Fig.23, with the third shutter time /v since the opening of the shutter, is F10/v, whilst the foreground component of the second left pixel, with the fourth shutter time /v since the opening of the shutter, is also F10v. The foreground component of the leftmost pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, is F09/v.

Since the object corresponding to the background is at a standstill, the background component of the second left pixel of the frame #n-1 in Fig.23, with the first shutter time/v as from the shutter opening time, is B01/v. The background component of the third left pixel of the frame #n-1 in Fig.23, with the first and second

shutter time/v as from the shutter opening time, is B02/v, while the background component of the fourth left pixel of the frame #n·1 in Fig.23, with the first to third shutter time/v as from the shutter opening time, is B03/v.

In the frame #n·1 in Fig.23, the leftmost pixel belongs to the foreground area, while the second to fourth left pixels belong to the mixed area which is the covered background area.

The fifth to twelfth left pixels of the frame #n·1 in Fig.23 belong to the background area, with the corresponding pixel values being B04 to B11, respectively.

The first to fifth pixels of the frame #n·1 in Fig.23 belong to the background area. The foreground component in the foreground area of the frame #n, with the shutter time/v, is one of F05v to F12/v.

Since the object corresponding to the foreground is a rigid body and may be assumed to be moving at a constant speed, with the foreground picture being moved so that the foreground picture will be displayed four pixels rightwards in the next frame, the foreground component of the fifth left pixel of the frame #n·in Fig.23, with the first shutter time /v since the opening of the shutter, is F12/v, whilst the foreground component of the sixth left pixel, with the second shutter time /v since the opening of the shutter, is also F12v. The foreground component of the seventh left pixel in Fig.23, with the third shutter time/v since the opening of the shutter, and the foreground component of the eighth left pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, are each F12/v.

The foreground component of the fifth left pixel of the frame #n in Fig.23, with the second shutter time /v since the opening of the shutter, is F11/v, whilst the foreground component of the sixth left pixel, with the third shutter time /v since the opening of the shutter, is also F11v. The foreground component of the seventh left pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, is F11/v.

The foreground component of the fifth left pixel of the frame #n in Fig.23, with the third shutter time /v since the opening of the shutter, is F10/v, whilst the foreground component of the sixth left pixel, with the fourth shutter time /v since the opening of the shutter, is also F10v. The foreground component of the fifth left pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, is F09/v.

Since the object corresponding to the background is at a standstill, the background component of the sixth left pixel of the frame #n in Fig.23, with the first shutter time/v as from the shutter opening time, is B05/v. The background component of the seventh left pixel of the frame #n in Fig.23, with the first and second shutter time/v as from the shutter opening time, is B06/v, while the background component of the eighth left pixel of the frame #n in Fig.23, with the first to third shutter time/v as from the shutter opening time, is B07/v.

In the frame #n-1 in Fig.23, the first to ninth left pixels belong to the foreground area, while the sixth to eighth left pixels belong to the mixed area which is the covered background area.

The first to ninth to twelfth left pixels of the frame #n+1 in Fig.23 belong to the

foreground area, with the pixel values being B08 to B11, respectively.

The first to ninth pixels of the frame #n+1 in Fig.23 belong to the foreground area. The foreground component in the foreground area of the frame #n+1, with the shutter time/v, is one of F01v to F12/v.

Since the object corresponding to the foreground is a rigid body and may be assumed to be moving at a constant speed, with the foreground picture being moved so that the foreground picture will be displayed four pixels rightwards in the next frame, the foreground component of the ninth left pixel of the frame #n+1 in Fig.23, with the first shutter time /v since the opening of the shutter, is F12/v, whilst the foreground component of the tenth left pixel, with the second shutter time /v since the opening of the shutter, is also F12v. The foreground component of the eleventh left pixel in Fig.23, with the third shutter time/v since the opening of the shutter, and the foreground component of the twelfth left pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, are each F12/v.

The foreground component of the ninth left pixel of the frame #n+1 in Fig.23, with the second shutter time /v since the opening of the shutter, is F11/v, whilst the foreground component of the tenth left pixel, with the third shutter time /v since the opening of the shutter, is also F11v. The foreground component of the eleventh left pixel in Fig.23, with the fourth shutter time/v since the opening of the shutter, is F11/v.

The foreground component of the ninth left pixel of the frame #n+1 in Fig.23, with the third shutter time /v since the opening of the shutter, is F10/v, whilst the

foreground component of the tenth left pixel, with the fourth shutter time /v since the opening of the shutter, is also F10v. The foreground component of the ninth left pixel of the frame #n+1in Fig.23, with the fourth shutter time/v since the opening of the shutter, is F09/v.

Since the object corresponding to the background is at a standstill, the background component of the tenth left pixel of the frame #n+1 in Fig.23, with the first shutter time/v as from the shutter opening time, is B09/v. The background component of the eleventh left pixel of the frame #n+1 in Fig.23, with the first and second shutter time/v as from the shutter opening time, is B10/v, while the background component of the twelfth left pixel of the frame #n+1 in Fig.23, with the first to third shutter time/v as from the shutter opening time, is B11/v.

In the frame #n+1 in Fig.23, the tenth to twelfth left pixels correspond to the mixed area which is the covered background area.

Fig.24 diagrammatically shows a picture obtained on extracting the foreground component from the pixel values shown in Fig.23.

Fig.25 shows neighboring pixels in a row of each of three frames of a photographed picture of the foreground corresponding to an object moving rightwards in the drawing, along with the still background. In Fig.25, there is also shown the uncovered background area.

In Fig.25, the object corresponding to the foreground is a rigid body and may be assumed to be moving at a constant speed, with the foreground picture being moved

so that the foreground picture will be displayed four pixels rightwards in the next frame. So, the movement quantity v of the foreground is 4.

For example, the foreground component of the leftmost pixel of the frame #n·1 in Fig.25, with the first shutter time /v since the opening of the shutter, is F13/v, whilst the foreground component of the second left pixel, with the second shutter time /v since the opening of the shutter, is also F13v. The foreground component of the third left pixel in Fig.23, with the second shutter time/v since the opening of the shutter, and the foreground component of the fourth left pixel in Fig.25, with the fourth shutter time/v since the opening of the shutter, are each F13/v.

For example, the foreground component of the second left pixel of the frame #n·1 in Fig.23, with the first shutter time /v since the opening of the shutter, is F14/v, whilst the foreground component of the third left pixel, with the second shutter time /v since the opening of the shutter, is also F14v. The foreground component of the third left pixel in Fig.25, with the first shutter time/v since the opening of the shutter, is F15/v.

Since the object corresponding to the background is at a standstill, the background component of the leftmost pixel of the frame #n·1 in Fig.25, with the second to fourth shutter time/v as from the shutter opening time, is B01/v. The background component of the second left pixel of the frame #n·1 in Fig.25, with the third and fourth shutter time/v as from the shutter opening time, is B26/v, while the background component of the third left pixel of the frame #n·1 in Fig.25, with the

fourth shutter time/v as from the shutter opening time, is B27/v.

In the frame #n-1 in Fig.25, the first to third left pixel belongs to the mixed area which is the covered background area.

The fourth to twelfth left pixels of the frame #n-1 in Fig.25 belong to the foreground area, with the foreground component of the foreground of the frame being one of F13v to F24v.

The first to fourth left pixels of the frame #n in Fig.25 belong to the background area, with the pixel values being B25 to B28, respectively.

Since the object corresponding to the foreground is a rigid body and may be assumed to be moving at a constant speed, with the foreground picture being moved so that the foreground picture will be displayed four pixels rightwards in the next frame, the foreground component of the fifth left pixel of the frame #n in Fig.23, with the first shutter time /v since the opening of the shutter, is F13/v, whilst the foreground component of the sixth left pixel, with the second shutter time /v since the opening of the shutter, is also F13v. The foreground component of the seventh left pixel in Fig.25, with the third shutter time/v since the opening of the shutter, and the foreground component of the eighth left pixel in Fig.25, with the fourth shutter time/v since the opening of the shutter, are each F13/v.

The foreground component of the sixth left pixel of the frame #n in Fig.23, with the first shutter time /v since the opening of the shutter, is F14/v, whilst the foreground component of the seventh left pixel, with the second shutter time /v since the opening

of the shutter, is also F14v. The foreground component of the eighth left pixel in Fig.25, with the first shutter time/v since the opening of the shutter, is F15/v.

Since the object corresponding to the background is at a standstill, the background component of the fifth left pixel of the frame #n in Fig.25, with the second to fourth shutter time/v as from the shutter opening time, is B29/v. The background component of the sixth left pixel of the frame #n in Fig.25, with the third and fourth shutter time/v as from the shutter opening time, is B30/v, while the background component of the seventh left pixel of the frame #n in Fig.23, with the fourth shutter time/v as from the shutter opening time, is B31/v.

In the frame #n in Fig.25, the first to ninth left pixels belong to the foreground area, while the fifth to seventh left pixels belong to the mixed area which is the covered background area

The eighth to twelfth left pixels of the frame #n+1 in Fig.25 belong to the foreground area, with the pixel values being B25 to B32, respectively.

The first to eighth pixels of the frame #n+1 in Fig.25 belong to the background area, with the pixel values being B25 to B32, respectively.

Since the object corresponding to the foreground is a rigid body and may be assumed to be moving at a constant speed, with the foreground picture being moved so that the foreground picture will be displayed four pixels rightwards in the next frame, the foreground component of the ninth left pixel of the frame #n+1 in Fig.25, with the first shutter time /v since the opening of the shutter, is F13/v, whilst the

foreground component of the tenth left pixel, with the second shutter time /v since the opening of the shutter, is also F13v. The foreground component of the eleventh left pixel in Fig.25, with the third shutter time/v since the opening of the shutter, and the foreground component of the twelfth left pixel in Fig.25, with the fourth shutter time/v since the opening of the shutter, are each F13/v.

The foreground component of the tenth left pixel of the frame #n+1 in Fig.25, with the first shutter time /v since the opening of the shutter, is F14/v, whilst the foreground component of the eleventh left pixel, with the second shutter time /v since the opening of the shutter, is also F14v. The foreground component of the twelfth left pixel in Fig.25, with the first shutter time/v since the opening of the shutter, is F15/v.

Since the object corresponding to the background is at a standstill, the background component of the ninth left pixel of the frame #n+1 in Fig.25, with the second to fourth shutter time/v as from the shutter opening time, is B33/v. The background component of the tenth left pixel of the frame #n+1 in Fig.25, with the third and fourth shutter time/v as from the shutter opening time, is B34/v, while the background component of the eleventh left pixel of the frame #n+1 in Fig.25, with the fourth shutter time/v as from the shutter opening time, is B35/v.

In the frame #n+1 in Fig.25, the ninth to eleventh left pixels correspond to the mixed area which is the covered background area.

In Fig.25, the twelfth left pixel of the frame #n+1 belong to the foreground area. The foreground component with the shutter time/v in the foreground area of frame

#n+1 is one of F13v to F16v.

Fig.26 diagrammatically shows a picture obtained on extracting the foreground component from the pixel values shown in Fig.25.

Reverting to Fig.10, the area specifying unit 103 associates a flag, indicating that a given picture belong to the foreground area, a background area, a covered background area or an uncovered background area, from pixel to pixel, using pixel value of plural frames, and routes the resulting areal information to the mixing ratio calculating unit 104 and to the motion blurring adjustment unit 106.

Based on the pixel values of plural frames and the areal information, the mixing ratio calculating unit 104 computes the mixing ratio α for each of the pixels contained in the mixed area, and sends the computed mixing ratio α to the foreground/background separating unit 105.

Based on the pixel values of the plural frames, areal information and the mixing ratio α, the foreground/background separating unit 105 extracts the foreground component picture made up only of the foreground component to send the extracted component picture to the motion blurring adjustment unit 106.

Based on the foreground component picture sent from the foreground/background separating unit 105, the motion vector sent from the motion detection unit 102 and on the areal information sent from the area specifying unit 103, the motion blurring adjustment unit 106 adjusts the quantity of the motion blurring contained in the foreground component picture to output the foreground component

picture adjusted for the motion blurring.

Referring to the flowchart of Fig.27, the processing for adjusting the motion blurring caused by the signal processor 12 is explained. At step S101, the area specifying unit 103 executes the area specifying processing for generating the areal information indicating to which of the foreground area, background area, covered background area or the uncovered background area belong the pixels of the input picture, from one pixel of the input picture to another. The area specifying processing will be explained subsequently by referring to the flowchart of Fig.36. The area specifying unit 103 sends the generated area information to the mixing ratio calculating unit 104.

Meanwhile, the area specifying unit 103 at step S101 may generate the areal information indicating to which of the foreground area, background area or the mixed area belong the pixels of the input picture, from one pixel of the input picture to another, based on the input picture. In this case, no distinction is made between the covered background area and the uncovered background area. In this case, the foreground/background separating unit 105 and the motion blurring adjustment unit 106 decide whether the mixed area is the covered background area or the uncovered background area, based on the direction of the motion vector. For example, if the foreground area, mixed area and the background area are arrayed sequentially in association with the direction of the motion vector, the mixed area is verified to be the covered background area, whereas, if the background area, mixed area and the

foreground area are arrayed sequentially in association with the direction of the motion vector, the mixed area is verified to be the uncovered background area.

At step S102, the mixing ratio calculating unit 104 calculates the mixing ratio α, from one pixel contained in the mixing area to another, based on the input picture and the area information. The processing for computing the mixing ratio will be explained in detail subsequently by referring to the flowchart of Fig.46. The mixing ratio calculating unit 104 sends the computed mixing ratio α to the foreground/background separating unit 105.

At step S103, the foreground/background separating unit 105 extracts the foreground component from the input picture, based on the motion vector and the areal information, to send the extracted component to the motion blurring adjustment unit 106 as the foreground component picture.

At step S104, the motion blurring adjustment unit 106 generates a processing unit for indicating a position on the picture of pixels arrayed consecutively in the movement direction of each of the uncovered background area, foreground area and the covered background area, based on the motion vector and on the area information, to adjust the quantity of the motion blurring contained in the foreground component corresponding to the processing unit. The processing for adjusting the quality of the motion blurring will be explained subsequently by referring to the flowchart of Fig.63.

At step S105, the signal processor 12 verifies whether or not the processing has been finished for the entire picture. If the signal processor 12 has verified that the

processing has not been finished fort the entire picture, it proceeds to step S104 to repeat the processing for adjusting the quantity of the motion blurring for the foreground component corresponding to the processing unit.

If, at step S106, it is verified that the processing has been finished for the entire picture, the processing is terminated.

In this manner, the signal processor 12 is able to separate the foreground and the background from each other to adjust the quantity of the motion blurring contained in the foreground. That is, the signal processor 12 is able to adjust the amount of motion blurring contained in sample data as pixel value of the foreground pixel.

In the following, illustrative structures of the area specifying unit 103, mixing ratio calculating unit 104, foreground/background separating unit 105 and the motion blurring adjustment unit 106 are hereinafter explained.

Fig.28 is a block diagram showing an illustrative structure of the area specifying unit 103. A frame memory 121 stores an input picture on the frame basis. When a frame being processed is a frame #n, the frame memory 121 stores a frame #n-2, as a frame two frames before the frame #n, a frame #n-1, as a frame one frame before the frame #n, a frame #n+1, as a frame one frame after the frame #n, and a frame #n+2, as a frame two frames after the frame #n.

A still/movement discriminating unit 122-1 reads out a pixel value of a pixel of the frame #n+2 lying at the same position as the position on the picture of the pixel of the frame #n being area-specified, and a pixel value of a pixel of the frame #n+1

lying at the same position as the position on the picture of the pixel of the frame #n being area-specified, frcm the frame memory 121, to calculate an absolute value of the difference of the read-our pixel values. The still/movement discriminating unit 122-1 verifies whether or not the absolute value of the difference between the pixel value of the frame #n+2 and the frame #n+1 is larger than a predetermined threshold value Th. If it is verified that the absolute value of the difference is larger than the threshold value Th, the still/movement discriminating unit 122-1 routes a still/movement decision specifying the movement decision to an area decision unit 123-1. If it is verified that the absolute value o the difference between the pixel value of the frame #n+2 nd the pixel value of the frame #n+1 is not larger than the threshold value Th, the still/movement discriminating unit 122-1 routes a still/movement decision specifying the still decision to an area decision unit 123-1.

A still/movement discriminating unit 122-2 reads out a pixel value of a pixel of the frame #n+1 lying at the same position as the position on the picture of the pixel of the frame #n being area-specified, and a pixel value of a pixel of the frame #n+1 lying at the same position as the position on the picture of the pixel of the frame #n being area-specified, from the frame memory 121, to calculate an absolute value of the difference of the read-our pixel values. The still/movement discriminating unit 122-2 verifies whether or not the absolute value of the difference between the pixel value of the frame #n+1 and the frame #n is larger than a predetermined threshold value Th. If it is verified that the absolute value of the difference between the is larger than the

threshold value Th, the still/movement discriminating unit 122-1 routes a still/movement decision specifying the movement decision to an area decision unit 123-1and to an area decision unit 123-2. If it is verified that the absolute value of the difference between the pixel value of the pixel of the frame #n+1 and that of the pixel of the frame #n is not larger than the threshold value Th, the still/movement discriminating unit 122-1 routes a still/movement decision specifying the still decision to an area decision unit 123-1 and to an area decision unit 123-2.

A still/movement discriminating unit 122-3 reads out a pixel value of a pixel of the frame #n lying at the same position as the position on the picture of the pixel of the frame #n being area-specified, and a pixel value of a pixel of the frame #n-1 lying at the same position as the position on the picture of the pixel of the frame #n being area-specified, from the frame memory 121, to calculate an absolute value of the difference of the read-our pixel values. The still/movement discriminating unit 122-3 verifies whether or not the absolute value of the difference between the pixel value of the frame #n and the frame #n-1 is larger than a predetermined threshold value Th. If it is verified that the absolute value of the difference between the pixel values is larger than the threshold value Th, the still/movement discriminating unit 122-3 routes a still/movement decision specifying the movement decision to an area decision unit 123-1and to an area decision unit 123-3. If it is verified that the absolute value of the difference between the pixel value of the pixel of the frame #n and that of the pixel of the frame #n-1 is not larger than the threshold value Th, the still/movement

discriminating unit 122-3 routes a still/movement decision specifying the still decision to an area decision unit 123-2 and to an area decision unit 123-3.

A still/movement discriminating unit 122-4 reads out the pixel value of the pixel of the frame #n-1 lying at the same position as the position on the picture of the pixel of the frame #n being area-specified, and the pixel value of the pixel of the frame #n-2 lying at the same position on the picture of the pixel of the frame #n being area-specified, to calculate the absolute value of the difference of the pixel values. The still/movement discriminating unit 122-4 verifies whether or not the absolute value of the difference of the pixel value of the frame #n-1 and the pixel value of the frame #n-2 is larger than the predetermined threshold value Th. If the absolute value of the difference between the pixel value of the frame #n-1 and the pixel value of the frame #n-2 is verified to be larger than the threshold value Th, a still/movement decision indicating the decision for movement is routed to the area decision unit 123-3. If it is verified that the absolute value of the difference between the pixel value of the frame #n-1 and the pixel value of the frame #n-2 is not larger than the threshold value Th, the still/movement discriminating unit 122-4 routes a still/movement decision indicating the still decision to the area decision unit 123-3.

If the still/movement decision routed from the still/movement discriminating unit 122-1 indicates still and the still/movement decision routed from the still/movement discriminating unit 122-2 indicates movement, the area decision unit 123-1 decides that the pixel on the frame #n being area-specified belongs to the

uncovered background area and sets "1" in an uncovered background area decision flag associated with the pixel being area-specified for indicating that the pixel belongs to the uncovered background area.

If the still/movement decision routed from the still/movement discriminating unit 122-1 indicates movement and the still/movement decision routed from the still/movement discriminating unit 122-2 indicates still, the area decision unit 123-1 decides that the pixel on the frame #n being area-specified does not belong to the uncovered background area and sets "0" in an uncovered background area decision flag associated with the pixel being area-specified for indicating that the pixel does not belong to the uncovered background area.

The area decision unit 123-1 routes the uncovered background area decision flag, having "1" or "0" set in this manner, to a decision flag storage memory 124.

If the still/movement decision routed from the still/movement discriminating unit 122-2 indicates still and the still/movement decision routed from the still/movement discriminating unit 122-3 indicates still, the area decision unit 123-2 decides that the pixel on the frame #n being area-specified belongs to the still area and sets "1" in a still area decision flag associated with the pixel being area-specified for indicating that the pixel belongs to the uncovered background area.

If the still/movement decision routed from the still/movement discriminating unit 122-2 indicates movement or the still/movement decision routed from the still/movement discriminating unit 122-3 indicates movement, the area decision unit

123-2 decides that the pixel on the frame #n being area-specified does not belong to the still area and sets "0" in a still area decision flag associated with the pixel being area-specified for indicating that the pixel does not belong to the still area.

The area decision unit 123-2 routes the still area decision flag, thus having "1" or "0" set therein, to the decision flag storage memory 124.

If the still/movement decision routed from the still/movement discriminating unit 122-2 indicates movement and the still/movement decision routed from the still/movement discriminating unit 122-3 indicates movement, the area decision unit 123-2 decides that the pixel on the frame #n being area-specified belongs to the movement area and sets "1" in a movement area decision flag associated with the pixel being area-specified for indicating that the pixel belongs to the movement area.

If the still/movement decision routed from the still/movement discriminating unit 122-2 indicates still or the still/movement decision routed from the still/movement discriminating unit 122-3 indicates still, the area decision unit 123-2 decides that the pixel on the frame #n being area-specified does not belong to the movement area and sets "0" in a movement area decision flag associated with the pixel being area-specified for indicating that the pixel does not belong to the movement area.

The area decision unit 123-2 routes the movement area decision flag, thus having "1" or "0" set therein, to the decision flag storage memory 124.

If the still/movement decision routed from the still/movement discriminating unit 122-3 indicates movement and the still/movement decision routed from the

still/movement discriminating unit 122-4 indicates still, the area decision unit 123-3 decides that the pixel on the frame #n being area-specified belongs to the uncovered background area and sets "1" in a covered background area decision flag associated with the pixel being area-specified for indicating that the pixel belongs to the covered background area.

If the still/movement decision routed from the still/movement discriminating unit 122-3 indicates still or the still/movement decision routed from the still/movement discriminating unit 122-4 indicates movement, the area decision unit 123-3 decides that the pixel on the frame #n being area-specified does not belong to the covered background area and sets "0" in a covered background area decision flag associated with the pixel being area-specified for indicating that the pixel does not belong to the covered background area.

The area decision unit 123-3 routes the covered background area decision flag, thus having "1" or "0" set therein, to the covered background area decision flag storage memory 124.

The decision flag storage memory 124 stores the uncovered background area decision flag, sent from the area decision unit 123-1, the still area decision flag, sent from the area decision unit 123-2, the movement area decision flag, sent from the area decision unit 123-2, and the uncovered background area decision flag, sent from the area decision unit 123-3.

The decision flag storage memory 124 sends the uncovered background area

decision flag, still area decision flag, movement area decision flag and the covered background area decision flag to a synthesis unit 125. Based on the uncovered background area decision flag, still area decision flag, movement area decision flag and the covered background area decision flag, supplied from the decision flag storage memory 124, the synthesis unit generates the area information indicating to which of the uncovered background area, still area, movement area and the covered background area belong the respective pixels, and routes the information so generated to a decision flag storage frame memory 126.

The decision flag storage frame memory 126 stores the area information, supplied from the synthesis unit 125, while outputting the area information stored therein.

Referring to Figs.29 to 33, a typical processing by the area specifying unit 103 is explained.

When an object corresponding to the foreground is moving, the position of the picture corresponding to the object on the picture screen is changed from frame to frame. Referring to Fig.29, a picture corresponding to an object at a position Yn(x, y) in a frame #n is positioned at Yn+1(x,y) at the next frame #n+1.

Fig.30 diagrammatically shows a model of pixel values of a row of pixels neighboring to one another along the moving direction of the picture corresponding to the foreground. For example, if the movement direction of the picture corresponding to the foreground is horizontal relative to the picture screen, the

diagrammatic view of Fig.30 shows a model in which pixel values of pixels neighboring to one another on one line are developed in the time axis direction.

In Fig.30, the line in the frame #n is the same as one in the frame #n+1.

The components of the foreground corresponding to the object contained in the second to the thirteenth pixels as counted from left in the frame #n are included in the sixth to seventeenth pixels as counted from the left of the frame #n+1.

The pixels belonging to the covered background area in the frame #n are the eleventh to thirteenth pixels as counted from left, whilst the pixels belonging to the uncovered background area are the second to fourth pixels as counted from left. The pixels belonging to the covered background area in the frame #n+1 are the fifteenth to seventeenth pixels as counted from left, whilst the pixels belonging to the uncovered background area are the sixth to eighth pixels as counted from left.

In the example shown in Fig.30, since the foreground component in the frame #n are moved by four pixels in the frame #n+1, the movement quantity v is 4. The number of times of the virtual splitting corresponds to the movement quantity and is equal to 4.

The change in the pixel values of pixels belonging to the mixed area ahead and at back of the frame being considered is explained.

In the frame #n shown in Fig.31, in which the background is still and the movement quantity of the foreground v is 4, pixels belonging to the covered background area are fifteenth to seventeenth pixels from left. Since the movement

quantity v is 4, the fifteenth to seventeenth pixels from left in the directly previous frame #n-1 contain only the background components and belong to the background. The fifteenth to seventeenth pixels from left in the further previous frame #n-2 contain only the background components and belong to the background area.

Since the object corresponding to the background is still, the pixel value of the fifteenth pixel from the left of the frame #n-1 is not changed from the pixel value of the fifteenth pixel from the left of the frame #n-2. Similarly, the pixel value of the sixteenth pixel from the left of the frame #n-1 is not changed from the pixel value of the sixteenth pixel from the left of the frame #n-2, whilst the pixel value of the seventeenth pixel from the left of the frame #n-1 is not changed from the pixel value of the seventeenth pixel from the left of the frame #n-2.

That is, the pixels of the frame #n-1 and the frame #n-2 corresponding to the pixels belonging to the covered background area in the frame #n are comprised only of the background components and are not changed, so that the absolute value of the difference is substantially 0. So, the still/movement decision on the pixels of the frame #n-1 and frame #n-2 corresponding to the mixed area in the frame #n is made as being still by the still/moving discriminating unit 122-4.

Since the pixels belonging to the covered background area in the frame #n contain the foreground components, the corresponding pixel values differ from those in which the pixels are comprised only of background components in the frame #n-1. Therefore, the pixels belonging to the mixed area in the frame #n and the

corresponding pixels of the frame #n-1 are verified to be moving pixels by the still/moving discriminating unit 122-3.

When fed with the result of still/movement decision indicating the movement from the still/moving discriminating unit 122-3 and with the result of still/movement decision indicating the still from the still/moving discriminating unit 122-4, the area decision unit 123-3 decides that the pixel in question belongs to the covered background area.

The pixels contained in the uncovered background area in the frame #n in which the background is still and the movement quantity v of the foreground is 4 are second to fourth pixels as counted from left. Since the movement quantity v is 4, the second to fourth pixels from left in the next frame #n+1 contain only the background components and belong to the background area. In the second next frame #n+2, the second to fourth pixels from left contain only the background components and belong to the background area.

Since the object corresponding to the background is still, the pixel value of the second pixel from left of the frame #n+2 is not changed from the pixel value of the second pixel from left of the frame #n+1. Similarly, the pixel value of the second pixel from left of the frame #n+2 is not changed from the pixel value of the second pixel from left of the frame #n+1, whilst the pixel value of the third pixel from left of the frame #n+2 is not changed from the pixel value of the fourth pixel from left of the frame #n+1.

That is, the pixels of the frame #n+1 and frame #n+2 corresponding to the pixels belonging to the uncovered background area in the frame #n are composed only of background components and are not changed in the pixel values. So, the absolute value of the difference is approximately zero. Therefore, the pixels of the frame #n+1 and frame #n+2 corresponding to the pixels belonging to the mixed area in the frame #n are decided by the still/moving discriminating unit 122-1 to be still pixels.

The pixels belonging to the uncovered background area in the frame #n contain the foreground components and hence differ in pixel values from the pixels in the frame #n+1 composed only of the background components. So, the pixels belonging to the mixed area in the frame #n and those of the corresponding frame #n-1 are decided by the still/moving discriminating unit 122-2 to be moving pixels.

The area decision unit 123-1 is fed in this manner with the result indicating movement from the still/moving discriminating unit 122-2. If fed with the result indicating still from the still/moving discriminating unit 122-1, the area decision unit 123-1 decides that the corresponding pixel belongs to the uncovered background area.

Fig.33 shows decision conditions of the area specifying unit 103 in the frame #n. When the pixel of the frame #n-2 at the same position as the position on the picture of the pixel of the frame #n being verified and the pixel of the frame #n-1 at the same position as the position on the picture of the pixel of the frame #n being verified, are decided to be still, whilst the pixel of the frame #n-1 at the same position as the position on the picture of the pixel of the frame #n being verified and the pixel

of the frame #n are decided to be moving, the area specifying unit 103 decides that the pixel of the frame #n being verified belongs to the covered background area.

When the pixel of the frame #n-1 at the same position as the position on the picture of the pixel of the frame #n being verified and the pixel of the frame #n are decided to be still, whilst the pixel of the frame #n and the pixel of the frame #n+1 at the same position as the position on the picture of the pixel of the frame #n being verified are decided to be still, the area specifying unit 103 decides that the pixel of the frame #n being verified belongs to the still area.

When the pixel of the frame #n-1 at the same position as the position on the picture of the pixel of the frame #n being verified and the pixel of the frame #n are decided to be moving, whilst the pixel of the frame #n and the pixel of the frame #n+1 at the same position as the position on the picture of the pixel of the frame #n being verified are decided to be still, the area specifying unit 103 decides that the pixel of the frame #n being verified belongs to the moving area.

When the pixel of the frame #n and the pixel of the frame #n+1 at the same position as the position on the picture of the pixel of the frame #n being verified are decided to be moving and when the pixel of the frame #n+1 at the same position as the position on the picture of the pixel of the frame #n being verified and the pixel of the frame #n+1 at the same position as the position on the picture of the pixel of the frame #n being verified and the pixel of the frame #n+2 at the same position as the position on the picture of the pixel of the frame #n being verified are decided to be still, the

area specifying unit 103 decides that the pixel of the frame #n being verified belongs to the uncovered background area.

Fig.34 shows an example of the area decision by the area specifying unit 103. In Fig.34A, a pixel decided to belong to the covered background area is shown in white. In Fig.34B, a pixel decided to belong to the uncovered background area is shown in white.

In Fig.34C, a pixel decided to belong to the moving area is shown in white. In Fig.34D, a pixel decided to belong to the still area is shown in white.

Fig.35 shows the area information representing the mixed area, among the area information output by the decision flag storage frame memory 126, as picture. In Fig.35, the pixel decided to belong to the covered background area or the uncovered background area, that is to the mixed area, is shown in white. The area information indicating the mixed area, output by the decision flag storage frame memory 126, indicates a textured portion surrounded by an untextured portion in the foreground area and the mixed area.

Referring to the flowchart of Fig.36, the processing for area identification by the area specifying unit 103 is explained. At step S121, the frame memory 121 acquires pictures of the frame #n-2 to frame #n+2, inclusive the frame #n.

At step S122, the still/moving discriminating unit 122-3 checks whether or not the pixels at the same position of the frame #n-1 and the frame #n are still. If the pixels are decided to be still, the program moves to step S123 where the still/moving

discriminating unit 122-2 checks whether or not the pixels at the same position of the frame #n and the frame #n+1 are still.

If, at step S123, the pixels at the same position of the frame #n and the pixel of the frame #n+1 are decided to be still, the program moves to step S124 where the area decision unit 123-2 sets "1" in the still area decision flag corresponding to the pixel of the area being verified for indicating that the pixel belongs to the still area. The area decision unit 123-2 sends the still area decision flag to the decision flag storage memory 124. The program then moves to step S125.

If at step S122 the pixels at the same position of the frame #n-1 and the frame #n are decided to be moving or if at step S123 the pixels at the same position of the frame #n and the frame #n+1 are decided to be moving, the pixel of the frame #n does not belong to the still area, so the processing at stepS124 is skipped and the program moves to step S125.

At step S125, the still/moving discriminating unit 122-3 checks whether or not the pixels at the same position of the frame #n-1 and the frame #n are moving. If the pixels are decided to be moving, the program moves to step S126 where the still/moving discriminating unit 122-2 decides whether or not the pixels at the same position of the frame #n and the frame #n+1 are moving.

If, at step S126, the pixels at the same position of the frame #n and the pixel of the frame #n+1 are decided to be moving, the program moves to step S127 where the area decision unit 123-2 sets "1" in the movung area decision flag corresponding to the